**MASTER OF SCIENCE (PHYSICS)**

**SEMESTER –I**

**CORE COURSE -1: CLASSICAL MECHANICS THERMODYNAMICS AND STATISTICAL PHYSICS (21PPH01)**

**COURSE OUTCOMES (COs):**

After the successful completion of this course, the students will be able to

**CO1:** By building an understanding of the kinetic and potential energies of a system, the lagrangian and Hamiltonian functions of systems will be set up in order to arrive at the equations of motion.

**CO2:** The behaviour of micro and macro molecules under the effect of central forces will be analysed by studying rigid body mechanics and poison brackets. motion in non-inertial frames of reference.

**CO3** will also be studied in order to understand the effect of forces acting on rotating particles.

**CO4:** To summarise several of the energy ensembles

**CO5:** This subject provides in-depth knowledge of mechanical systems and an analysis of the constraints present within them.

**CORE COURSE II: MATHEMATICAL PHYSICS (21PPH02)**

**COURSE OUTCOMES (COs):**

After the successful completion of this course, the students will be able to

**CO1:** These physical parameters include mechanical, thermal, optical, electrical, and magnetic properties. The system of study is nanoscale structure through micro, mesa, and bulk systems.

**CO2:** Quantitative understanding of physical processes and parameters requires various mathematical methods to solve the given problem subjected to known boundary conditions.

**CO3:** The prescribed course runs through various topics, which include vector integration, the Gauss-Stoke theorem, matrices, tensors, etc.

**CO4:** The special functions covered are quite useful in solving the transfer of heat in different geometries. Integral transformation helps the student study the time domain problem in the frequency domain.

**CO5:** After completing the course, students are expected to solve the problems of the physical system and get insight into the solution.

**CORE COURSE –III: ELECTRONICS (21UPH03)**

**COURSE OUTCOMES (COs):**

After the successful completion of this course, the students will be able to

**CO1:** To learn what thermal equilibrium is, why it is needed, and where it finds its application, study the basics of transistors and their working and implementation.

**CO2:**To study the various circuits like ujt, scr, and triac, to study different biassing techniques to operate transistors, fet, and mosfet, and to know the principles of operation of photoelectric devices like photodiodes and LEDs.

**CO3:** To identify and review the various configurations, like the common base, the common emitter configuration, and their v-i characteristics, to interpret the difference between the emitter follower and the common collector configuration.

**CO4:** To contemplate with the multistage amplifier to examine cmr like common mode gain and difference mode gain to describe dc load line and bias point and different biassing circuits.

**CO5:**To understand and analyse the IC 741 operational amplifier and its characteristics to deliberate on the solution for linear and non-linear applications to elucidate and design the phase and frequency response of low-pass, high-pass, and band-pass filters to outline the summing amplifier, inverting, and non-inverting configurations.

**ELECTIVE COURSE –I: MICROPROCESSOR AND MICROCONTROLLERS (21PPHE01)**

**COURSE OUTCOMES (COs):**

After the successful completion of this course, the students will be able to

**CO1:** Design circuits for various mathematical operations using op-amps.

**CO2:** Explain the workings and design of various flip-flops, encoders and decoders, multiplexers, registers, and counters.

**CO3:** Describe the working and design of the ROM, RAM, and memory storage cell, as well as the various read and write operations.

**CO4:** Explain the working and design of various a/d and d/a converters.

**CO5: Explain the** various components and workings of the 8085 microprocessor and their peripheral devices.

**EDC PAPER-I: FUNDAMENTALS OF COMPUTERS AND COMMUNICATION (21 PCSED2)**

**COURSE OUTCOMES (COs):**

After the successful completion of this course, the students will be able to

**CO1:** Introduction to energy sources energy sources and their availability.

**CO2:** Solar cells for direct conversion of solar energy to electric power; solar cell parameters; solar cell electrical characteristics

**CO3:** Solar energy—applications

**CO4:** Wind energy: basic principles and components of wind energy conversion systems

**CO5:** Biomass conversion technologies—wet and dry processes—photosynthesis

**CORE PRACTICAL -1: GENERAL PHYSICS PRACTICAL (21 PHP01)**

**COURSE OUTCOMES (COs):**

After the successful completion of this course, the students will be able to

**CO1:** In this course, the experiments are designed to give a glimpse of heat, magnetism, electricity, and optics experiments.By measuring the thermal conductivity of a rod using the Forbes method, students realise heat conduction.

**CO2: The determination** of the elastic constants of a material by Cornu's interference method strengthens the understanding of interference as well as the concept of elastic properties.

**CO3:** Concept of the black body is clarified by the experiment of verification of Stefan’s law by the electrical method.

**CO4: The study** of coupled oscillators makes the analytical thinking of students stronger, as they get the same in classical mechanics theory.

**CO5: The measurement** of the refractive index of a liquid by shift assists the students in understanding the uses of laser, refractive index, and grating.

**SEMESTER-II**

**CORE COURSE IV: THEORY OF SEMICONDUCTORS DEVICE (21PPH04)**

**COURSE OUTCOMES (COs):**

After the successful completion of this course, the students will be able to

**CO1:** Radioactive transition, emission spectra, luminous efficiency, lead materials, solar cells, and photo detectors

**CO2:** ideal conversion efficiency, fill factor, equivalent circuit, voc, is and load resistance, spectral response, and reverse saturation current in a photodetector

**CO3:** Explain the basic properties of semiconductors, including the band gap, charge carrier concentration, doping, and charge carrier injection or excitation.

**CO4:** Explain the workings, design considerations, and applications of various semiconducting devices, including p-n junctions, bjts, and fets.

**CO5:** Describe the workings and design considerations for the various photonic devices like photo detectors, solar cells, and LEDs.

**CORE PAPER –V: QUANTUM MECHANICS –I (21PPH05)**

**COURSE OUTCOMES (COs):**

After the successful completion of this course, the students will be able to

**CO1:** The concept of wave function and wave packet is introduced. Students develop their critical thinking abilities by studying the uncertainty principle.

**CO2:** The study of probability, expectation value, and Ehrenfest’s theorem assists students in being enriched with mathematical calculation. The concept of the Schrodinger equation creates the analytical power of students.

**CO3:** The knowledge of quantization is clarified by studying energy levels.

**CO4:** The study of different potentials nourishes them to think about a system and its function with the help of mathematical tools.

**CO5:** Students get skilled by studying the formalism of quantum mechanics in describing systems mathematically, and this knowledge becomes very useful for their study of particle physics, spectroscopy, and research.

**CORE PAPER- VI: COMPUTATIONAL PHYSICS C++ PROGRAMMING (21PPH06)**

**COURSE OUTCOMES (COs):**

After the successful completion of this course, the students will be able to

**CO1:** In this course, probability, statistics, experimental measurements, error, numerical methods, and the use of computational approaches in physics are covered.

**CO2:** Studying probability and statistics helps students get acquainted with statistical calculations that can be used in real-life applications.

**CO3:** Understanding the error, data fitting assists students to get practiced with error analysis.

**CO4:** The knowledge of numerical methods functions as an advantage to the students as they realise the numerical steps of calculus.

**CO5:** Finally, applications of the computational approach in physics make students ready for research and development.

**CORE PRACTICAL: –II: ELECTRONICS PRACTICAL (21PPHP02)**

**COURSE OUTCOMES (COs):**

After the successful completion of this course, the students will be able to

**CO1:** The basic filters will help the student identify how the frequency depends on resistance and how the signals behave with the frequencies.

**CO2:** The experiments related to operational amplifiers make the students analyse and work on IC 741 and its characteristics, finding solutions for linear and nonlinear applications using op-amps.

**CO3:** To appreciate and differentiate the working principles. How the resistor-capacitor combination affects the uniformity of the waveform and how to comprehend the difficulties and overcome them.

**CO4:** The study of basic logic gates will help the student to have a thorough understanding of the fundamental concept and the various techniques in digital electronics.

**CO5:** To understand the boolean algebra and the basic properties of boolean algebra and will be able to simplify the simple boolean expression using the properties.

**ELECTIVE COURSE: II: NANO PHYSICS (21PPHE02)**

**COURSE OUTCOMES (COs):**

After the successful completion of this course, the students will be able to

**CO1:** Gain knowledge about nanoscale systems.

**CO2:** To know the synthesis of nanostructured materials.

**CO3:** Gain knowledge about quantum dots.

**CO4:** To know characterization: nanoSEM: scanning, conducting microscopy

**CO5:** To know the applications of nanotechnology.

**COMMON PAPER: HUMAN RIGHTS (21PHR01)**

**COURSE OUTCOMES (COs):**

After the successful completion of this course, the students will be able to

**CO1:** To impart the basic ideas about human rights at the post-graduation level.

**CO2:** This paper provides different aspects of human rights, which include children and women.

**CO3:** Students can learn not only their basic rights but also understand the duties to be carried out in the days to come.

**CO4:** Introduction to Human Rights

**CO5:** Understand the multi-dimensional aspects of human rights.

**SEMESTER –III**

**CORE PAPER–VII: ELECTROMAGNETIC THEORY PLASMA PHYSICS (21PPH07)**

**COURSE OUTCOMES (COs):**

After the successful completion of this course, the students will be able to

**CO1:** Understand the basic mathematical concepts related to electromagnetic vector fields.

**CO2:** Apply the principles of electrostatics to the solutions to problems relating to electric field and electric potential, boundary conditions, and electric energy density.

**CO3:** Apply the principles of magnetostatics to the solutions to problems relating to magnetic field and magnetic potential, boundary conditions, and magnetic energy density.

**CO4:** Understand the concepts related to Faraday's law, induced emf, and Maxwell's equations.

**CO5:** Apply Maxwell’s equations to solutions to problems relating to transmission lines and uniform plane wave propagation.

**CORE PAPER VIII: QUANTUM MECHANICS –II (21PPH08)**

**COURSE OUTCOMES (COs):**

After the successful completion of this course, the students will be able to

**CO1:** Scattering theory and validity of bonn approximations, partial wave analysis

**CO2:** Importance of relativistic quantum mechanics compared to no relativistic quantum mechanics

**CO3:** Various tools to understand field quantization and related concepts

**CO4:** Exposure to quantum field theory and universal interactions

**CO5:** The basics of the subject are designed here to grow the concept amongst the students.

**CORE PAPER IX: MOLECULAR PHYSICS AND SPECTROSCOPY (21PPH09)**

**COURSE OUTCOMES (COS):**

After the successful completion of this course, the students will be able to

**CO1:** Justify and deduce the wave functions of the h-atom from Rodriguez formulas, write down energy levels and degeneracy, and formulate and derive perturbation corrections.

**CO2:** Describe models for helium and multielectron atoms and their electronic spectra, and distinguish various angular momentum coupling schemes and their consequences.

**CO3:** Apply time-dependent perturbation theory to analyse emission and absorption spectra of atoms, transition probabilities, selection rules to explain electronic spectra of atoms and their line widths, and describe and classify basic laser types and their operation principles.

**CO4:** Describe models, the Frank-Condon principle, and analyse consequences to explain the electronic, rotational, and vibration spectra of diatomic molecules; explain IR spectroscopy.

**CO5:** Describe and apply the models of polyatomic molecules to explain electronic, vibrational, and rotational levels; the classical and quantum theories of the Raman effect and spectroscopy; and calculate parameters of interest.

**CORE PRACTICAL: MICROPROCESSOR AND MICROCONTROLLER PRACTICAL (21PPHP03)**

**COURSE OUTCOMES(COs):**

After the successful completion of this course, the students will be able to:

**CO1:** Understand the architecture of 8085 and 8051.

**CO2:** Impart knowledge about the instruction set.

**CO3:** Understand the basic idea about data transfer schemes and their applications.

**CO4:** Develop skills in simple programme writing for 8051 and 8085 and applications.

**CO5:** To introduce the need and use of interrupt structures 8085 and 8051.

**ELECTIVE III ELECTRONICS COMMUNICATION (21PPHE06**)

**COURSE OUTCOMES (COs):**

After the successful completion of this course, the students will be able to

**CO1:** Impart the knowledge of the propagation of waves and transmission lines.

**CO2:** To know waveguides, antennas, and resonators.

**CO3:** Togain knowledge about microwave devices and radars.

**CO4:** To know satellite communications.

**CO5:** To know mobile communication.

**EDC COURSE: II—BUSINESS COMMUNICATION (19PCZED1)**

**COURSE OUTCOMES (COs):**

After the successful completion of this course, the students will be able to

**CO1:** Understand the essentials of effective business letters.

**CO2:** Draft an application for employment.

**CO3:** Gain practical knowledge to face an interview.

**CO4:** Developing writing skills for secretarial correspondence

**CO5:** Exploring practical knowledge for bank and insurance correspondence

**SEMESTER-IV**

**CORE PAPER X: NUCLEAR AND ELEMENTARY PARTICLE**

**PHYSICS (21PPH10)**

**COURSE OUTCOMES (COs):**

After the successful completion of this course, the students will be able to:

**CO1:** Interaction of gamma rays with particles introduces clarity to the concepts of Compton scattering, pair production, and the photoelectric effect.

**CO2:** The study of nuclear forces and characteristics assists in developing inclusive knowledge of the nuclear structure. The concept of technical thinking using physical phenomena is cultivated by studying the topics of nuclear detectors and nuclear electronics.

**CO3:** Study of liquid drop models provides the skill of preparing empirical models. Analytical understanding is developed by studying the shell model.

**CO4:** Concept of experimental results and their representation in theory is developed by studying the fermi theory of beta decay and the Kurie plot. Students get equipped with an understanding of experimental plots.

**CO5:** Comprehensive knowledge is gathered after going through the basics of particle physics. Particles and their properties are well understood by this topic.

**CORE PAPER –XI CONDENSED MATTER PHYSICS (21PPH11)**

**COURSE OUTCOMES (COs):**

After the successful completion of this course, the students will be able to

**CO1:** Studies, which is a great tool to determine the crystal structures The second module discusses the free electron theory of metals, where this theory successfully accounts for a wide range of metallic properties like thermal conductivity, specific heat capacities, electrical conductivity of metals, their temperature dependence, etc.

**CO2:** Followed by this module, the course introduces the other classes of solids, like semiconductors and superconductors, where it discusses their electronic properties and explains their origin.

**CO3:** Final module of the course describes the dielectric properties of insulators, internal fields in dielectrics, and various types of magnetic phenomena like diamagnetism, paramagnetism, ferromagnetism, antiferromagnetism, and ferrimagnetism exhibited by different solids. It also introduces the students to the theories that explain the origin of these magnetic properties in solids.

**CO4:** This course aims to establish the fundamental concepts of condensed matter physics for students and also provides the knowledge to apply other concepts of physics that have been previously learned by the students, particularly in quantum mechanics, classical mechanics, electromagnetism, and statistical mechanics.

**CO5:** Research in condensed matter physics has given rise to enormous technological applications that we witness in our daily lives. The fundamental knowledge of condensed matter physics is very essential and plays a major role in other research areas like material science, nanomaterial science, functional materials, spintronics, quantum computing, biophysics, cryogenics, low-dimensional semiconductors, etc.

**CORE PRACTICAL- IV: MICRO CONTROLLER AND C++**

**PROGRAMMING (21PPHP04)**

**COURSE OUTCOMES (COs):**

After the successful completion of this course, the students will be able to

**CO1:** Architecture of 8051: 8051 microcontroller hardware: oscillator and clock, role of pc and depth, flags and psw, cpu registers, internal ram and ram organisation.

**CO2:** Internal memory, special function registers, i/o pins, ports, and circuits; external memory; counters and timers; serial transmission; interrupts.

**CO3:** Design input, processing, and output structures to solve problems using programmes.

**CO4:** Write C++ code using various control structures and functions.

**CO5:** Introduction to computers and programming; introduction to C++; expressions and interactivity; making decisions; looping; functions; arrays; sorting arrays.

**ELECTIVE VI: NON CONVENTIONAL ENERGY RESOURCES (21PPHE05**)

**COURSE OUTCOMES (COS):**

After the successful completion of this course, the students will be able to

**CO1:** To explain the concepts of renewable energy systems.

**CO2:** To outline the utilisation of renewable energy sources for both domestic and industrial applications.

**CO3:** An understanding of renewable energy sources

**CO4:** Knowledge of the working principles of various energy systems.

**CO5:** Capability to carry out the basic design of renewable energy systems

**CORE COURSE –XII**: **PROJECT VIVA –VOCE (21PPHPR1)**

**COURSE OUTCOMES (COS):**

After the successful completion of this course, the students will be able to

**CO1:** Demonstrate a thorough and systematic understanding of project contents.

**CO2:** Understand methodologies and professional ways of documentation and communication.

**CO3:** Know the key stages in the development of the project. Extend or use the idea in a mini-project for a major project.

**CO4:** To follow correct grounding and shielding practices to do effective troubleshooting of the mini project.

**CO5:** To develop effective communication skills by delivering a seminar based on a mini-project.